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PTT-130(402559US)

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INTERNATIONAL APPLICATION NO.

INTERNATIONAL FILING DATE

PRIORITY DATE CLAIMED

PCT/EPO/06403

05 July 2000

12 July 1999

TITLE OF INVENTION

OPTICAL TRANSMISSION NETWORK HAVING A PROTECTION CONFIGURATION

APPLICANT(S) FOR DO/EO/US

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Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☐ This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below.
4. ☐ The US has been elected by the expiration of 19 months from the priority date (Article 31).
5. ☐ A copy of the International Application as filed (35 U.S.C. 371(c)(2)).
- a. ☐ is attached hereto (required only if not communicated by the International Bureau).
- b. ☐ has been communicated by the International Bureau.
- c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☐ An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
- a. ☐ is attached hereto.
- b. ☐ has been previously submitted under 35 U.S.C. 154(d)(4).
7. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3)).
- a. ☐ are attached hereto (required only if not communicated by the International Bureau).
- b. ☐ have been communicated by the International Bureau.
- c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
- d. ☐ have not been made and will not be made.
8. ☐ An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371 (c)(3)).
9. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ An English language translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11 to 20 below concern document(s) or information included:

11. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98. (with Form PTO/SB08A-B, copy of International Search Report and three (3) references)
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☒ A **FIRST** preliminary amendment.
14. ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
15. ☐ A substitute specification.
16. ☐ A change of power of attorney and/or address letter.
17. ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.
18. ☐ A second copy of the published international application under 35 U.S.C. 154(d)(4).
19. ☐ A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).
20. ☒ Other items or information: postcard, Cover Letter (2 pgs.), Application Data Sheet (2 pgs.), copy of International Publication No. WO 01/05083 with seven (7) drawing sheet (FIGS. 1-9), copy of PCT Request (6 pgs.), copy of Notification of International Application Number and International Filing Date (1 pp.), copy of PCT Demand (5 pgs.), copy of Notification of Receipt of Demand (1 pp.), copy of Notification of Transmittal of the International Preliminary Examination Report with a copy of the International Preliminary Examination Report and six (6) amended sheets (claims), Submission of Priority Document with certified copy of NL Serial No. 1012568 (with English translation).

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IN THE UNITED STATES
RECEIVING OFFICE (RO/US)

PATENT APPLICATION

Applicants: **PETERS, Michiel Gerard;**
VAN DER TOL, Johannes Jacobus Gerardus Maria

Case: **PTT-130 (402559US)**

International Application No.: **PCT/EP00/06403**

International Filing Date: **05 July 2000**

Priority Date Claimed: **12 July 1999**

Title: **OPTICAL TRANSMISSION NETWORK HAVING A PROTECTION
CONFIGURATION**

COMMISSIONER FOR PATENTS

BOX PCT

Washington, D. C. 20231

S I R:

PRELIMINARY AMENDMENT

Please amend the above-identified patent
application which is simultaneously filed herewith, as
follows:

IN THE CLAIMS-

Delete claims 1-16 and substitute therefore the following
claims:

1 --17. Method for transmitting optical signals having
2 several priorities via a transmission network with
3 protection, comprising steps of:

4 transmitting an optical signal carrying traffic with a
5 high priority, hereinafter called high priority
6 signal (tr_H), via an operational connection ($WF; R1, R2$)
7 through the network;

8 transmitting an optical signal carrying traffic with a
9 low priority, hereinafter called low priority signal (tr_L),
10 via at least a part ($PF1$) of a protection connection ($PF;$
11 $R2, R1$);

12 protection switching for switching the traffic with
13 high priority from being carried by an optical signal
14 transmitted via the operational connection to being carried
15 by an optical signal transmitted via the protection
16 connection in the event of an error condition; and

17 giving way the transmission of the low priority signal
18 via at least said part of the protection connection in the
19 event of said error condition under control of a detection
20 of an optical signal signaling that a protection switching
21 has occurred,
22 characterized in that

23 the transmission network is an optical network, in
24 which the step of protection switching is carried out in
25 such a way that the high priority signal (tr_H) is switched
26 by optical switching means ($PS1; 73, 74$) from the
27 operational connection ($WF; R1, R2$) to the protection
28 connection ($PF; R2, R1$); and

29 the step of giving way is carried out upon detection of
30 a signal characteristic of the high priority signal (tr_H) on
31 the protection connection ($PF; R2, R1$).

1 18. Transmission method according to claim 16,
2 characterized in that the transmission of the low priority
3 signal is carried out at a first wavelength

4 spectrum ($\lambda_1, \dots, \lambda_n$), the transmission of the high priority
5 optical signals is carried out at a second wavelength
6 spectrum ($\lambda_1, \dots, \lambda_n, \lambda_s$), which differs from the first
7 wavelength spectrum, and the optical detection is carried
8 out on the optical characteristic which corresponds to a
9 difference spectrum (λ_s), in which the second wavelength
10 spectrum differs from the first one.

1 19. Transmission method according to claim 16,
2 characterized in that the transmission of the low priority
3 signal being carried out in a direction opposite to the one
4 of the transmission of the high priority signal in the event
of an error condition of the operational connection, and the
optical detection is carried out in a direction-selective
manner.

20. Transmission method according to claim 16,
characterized in that the high priority signal includes a
signal which is specific for the high priority signal, and
the optical detection is carried out in a manner selective
for said specific signal.

1 21. Transmission method according to claim 18,
2 characterized in that the switching is carried out by
3 switching means (S1; S2; S3; S4) between a first switching
4 mode, in which the low-priority signal is added or dropped,
5 respectively to and from the protection connection, and a
6 second switching mode, in which the high-priority signal
7 passes on over the protection connection.

1 22. Transmission method according to claim 21,
2 characterized in that the optical detection includes

optical-power splitting by optical-power splitting
means (C1) for tapping a part of the optical power present
on a port (p1) of the switching means (S1) to which an
incoming end of the protection connection (PF) is coupled.

23. Transmission method according to claim 21,
characterized in that the optical detection includes
optical-power splitting by optical-power splitting
means (C3) for tapping a portion of the optical power
present on a port (p4) of the switching means (S3) which, in
the first switching mode, are connected through to a further
port (p1) of the switching means to which an incoming end of
the protection connection (PF) is coupled.

24. Transmission method according to claim 21,
characterized in that the optical detection is carried out
directly on a port (p4) of the switching means (S4), which,
in the first switching mode, is connected through to a
further port (p1) of the switching means to which an
incoming end of the protection connection (PF) is coupled.

25. Transmission method according to claim 16,
characterized in that:
the high- and/or low-priority signals are optical WDM
signals ($\lambda_1, \dots, \lambda_n, \lambda_s; \{W1\}, \{W2\}, \{P1\}, \{P2\}$).

26. Transmission method according to claim 16,
characterized in that:
the high- and low-priority signals are WDM signals,
with the WDM signal of the low-priority signal comprising a
number of WDM channels ($\lambda_1, \dots, \lambda_n$) which is at least a subset

6 of the number of WDM channels ($\lambda_1, -, \lambda_n$; $\lambda_1, -, \lambda_n, \lambda_s$) in the
7 WDM signal of the high-priority signal;

8 on either side of said part (PF1) of the protection
9 connection, an OADM (40; 50) is included of which the
10 switching means (SP1, -, SPn; SQ1, -, SQn) and detection means
11 (MM1, -, MMn; MM) are part;

12 and in that, per OADM, the optical detection is carried
13 out on at least one ($\lambda_1, -, \lambda_n$; λ_s) of the WDM channels of the
14 high-priority signal, and the switching is carried out per
15 WDM channel of the low-priority signal through switching
16 means (SP1, -, SPn; SQ1, -, SQn) under control of the optical
17 detection (MM1, -, MMn; MM), the switching means having a
18 first switching mode for adding and dropping a low priority
19 signal and a second switching mode for passing on a high
20 priority signal.

21 27. Transmission method according to claim 26,
22 characterized in that the high-priority signal includes a
23 WDM channel having a wavelength (λ_s) which is specific to
24 the high-priority signal, and that the optical detection is
25 carried out by detection means (MM) coupled to the WDM
26 channel having said specific wavelength.

1 28. Transmission method according to claim 26,
2 characterized in that the optical detection is carried out
3 per WDM channel ($\lambda_1, -, \lambda_n$) by means of an optical signal
4 detector (MM1, -, MMn) for controlling the switching
5 means (SP1, -, SPn) associated with the WDM channel in
6 question.

1 29. Annular optical transmission network with protection,
2 for the transmission of optical WDM signals, comprising:

3 a number of nodes (RN1,...,RN4) included in, and mutually
4 connected by, two optical connections forming two optical
5 rings, hereinafter separately also referred to as first
6 ring (R1) and second ring (R2), for optical signal
7 transmission of WDM signals in two mutually opposite
8 transmission directions between the nodes;

9 each node (70) comprising a first OADM (71) included in
10 the first ring (R1) and a second OADM (72) included in the
11 second ring (R2), and optical protection-switching
12 means (73, 74) included between the two rings on either side
13 of the first and second OADM's for optical
14 protection-switching of WDM-signals between the two optical
15 rings,
16 characterized in that

17 each (R1;R2) of the two rings includes:

18 + a first set of WDM channels ($\{\lambda_w\}; \{W1\}; \{W2\}$),
19 called operational channels, for forming
20 operational connections over a concerned one (R1;
21 R2) of the two rings for the transmission of
22 optical signals of high priority; and

23 + a second set of WDM channels ($(\lambda_1, -, \lambda_n);$
24 $(\lambda_1, -, \lambda_n, \lambda_s); \{P2\}; \{P1\}$), called protection
25 channels, for the transmission of optical signals
26 of low priority ($tr_L; tr_L(1)$) in normal operation,
27 and for forming protection connections over said
28 concerned one (R1; R2) of the two rings for high
29 priority signals ($tr_H; tr_H(\lambda_s2)$) upon occurrence
30 of protection-switching in the event of an error
31 condition of an operational connection over the
32 other one (R2; R1) of the two rings, and

33 each OADM (40; 50; 90) includes:

34 + optical switching means $((SP1, -, SPn);$
 35 $(SQ1, -, SQn); SQ)$ for switching on and off low
 36 priority signals $(tr_L; tr_L(1))$ over any of the
 37 protection channels of a ring concerned $(R1; R2);$
 38 and
 39 + optical detection means $((MM1, -, MMn); MM)$ for
 40 detecting a high priority signal on at least one
 41 protection channel $((\lambda1, -, \lambda n); \lambda s; \lambda s2)$ of the set
 42 of protection channels.

1 30. Annular optical transmission network according to
 2 claim 29, characterized in that
 3 the first set $(\{W1\}; \{W2\})$ of WDM channels of each $(R1;$
 4 $R2)$ of the two rings includes a recognition channel $(\lambda s;$
 5 $\lambda s1, \lambda s2)$, which corresponds to a recognition channel having
 6 the same specific wavelength $(\lambda s; \lambda s1, \lambda s2)$ included in the
 7 second set $(\{P1\}; \{P2\})$ of WDM channels of the other one
 8 $(R2; R1)$ of the two rings, the and the optical detection
 9 means (MM) of each OADM have been coupled to the recognition
 10 channel $(\lambda s; \lambda s1, \lambda s2)$ of the second set of WDM channels for
 11 driving the switching means $(SQ1, -, SQn; SQ)$ of the WDM
 12 channels of the second set, the recognition channel of the
 13 first set of operations channels of one $(R1; R2)$ of the two
 14 rings having a specific wavelength $(\lambda s; \lambda s1, \lambda s2)$ for
 15 recognizing the high priority signal on the corresponding
 16 recognition channel of the second set of WDM channels of the
 17 other one $(R2; R1)$ of the two rings.

1 31. Annular optical transmission network according to
 2 claim 31, characterized in that each OADM includes an

add/drop means (98) for adding and dropping the recognition
channel (λ_{s1}) of the first set ($\{W1\}$) of WDM channels.

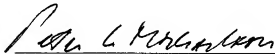
32. Annular optical transmission network according to
claim 31, characterized in that the detection means include
an optical-signal detector ($MM1, \dots, MMn$) per WDM channel
($\lambda1, \dots, \lambda n$) for controlling the switch ($SP1, \dots, SPn$) associated
with the WDM channel in question. --.

REMARKS

The foregoing amendment is made to conform the
claims in the application to that amended in the
International Preliminary Examination Report, to delete
multiple dependent claims and correct minor typographical
errors.

Respectfully submitted,

14 December 2001


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Optical transmission network having a protection configuration.A. BACKGROUND OF THE INVENTION

5 The invention lies in the area of optical transmission networks. More in particular, it concerns an optical transmission network having a protection configuration for transmitting optical signals having a low and a high priority, according to the preamble of claim 1.

10 Such an optical transmission network is disclosed in reference [1] (for more bibliographical detail, see below under C.).

For a protection configuration in optical transmission networks, basically four schemes are known, which are denoted by 1+1 protection, 1:1 protection, 1:N protection and M:N protection, respectively. Said schemes relate to signal transmission over one (schemes 1+1 and 1:1) or more (schemes 1+N and M:N) operational fibre connection(s) ("working fibre(s)") and one (schemes 1+1, 1:1 and 1:N) or more (scheme M:N) protection fibre connection(s) ("protection fibre(s)"), hereinafter to be referred to as an operational connection and a protection connection, respectively. In the 1+1 scheme, the signal transmission takes place over the operational connection and the protection connection simultaneously, the destination side selecting either of the two connections for receipt. In the 1:1 scheme and in its more general forms - the schemes 1:N and M:N - a protection connection is basically taken into use for signal transmission only in the event that the signal transmission over an operational connection is disturbed, such as, e.g., due to fibre rupture. With said three schemes, under normal, i.e., undisturbed operation, the protection connection is therefore not in use. Such connections, which are not used under normal circumstances, may be used for traffic having a low priority, as is known (see reference [1]), to increase the total traffic capacity, which traffic has to make way, however, for protection traffic which, in the event of a disturbed operational connection, is led via the protection connection, and which is assigned a high priority. In order not to disturb the protection

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traffic having a high priority, or at least to disturb it as little as possible, said making way must take place as fast as possible. In optical transmission networks, to which such protection schemes are being applied, switching over to a protection connection in most cases occurs under the control of a central operating system, or by way of a signalling protocol. The removal of the traffic having a low priority from a protection connection to be taken into use for protection traffic, too, might take place by intervention of a central control or by way of a signalling protocol expanded for that purpose. This would take place much too slowly, however. Therefore, there is the desire in a transmission network of the type referred to above to have the low-priority traffic on a protection connection give way to the high-priority traffic without intervention of a central control, or without applying any signalling protocol.

B. SUMMARY OF THE INVENTION

The object of the invention is to provide for an optical transmission network of the type referred to above, which accommodates the desire referred to above. For this purpose, the transmission system of the type referred to above according to the invention is characterised as in claim 1. In this connection, the invention makes use of the fact that, by means of optical detection of the presence of protection traffic on the protection connection it may be decided, in the optical domain itself, when the low-priority traffic of a relevant part of the protection connection must make way. In general, for the detection may be applied detection means may be applied which are selective for one or more signal characteristics in which the signals having high and low priorities differ from one another, such as, e.g., in wavelength, in transmission direction, or also via a signal component specific to the high-priority signal, such as a pilot signal. For this purpose, in preferred embodiments the invention has the characteristics of claim 2, claim 3 and claim 4, respectively.

Annular optical networks are typically suitable to the application of protection configurations according to a 1:1 scheme or, in the event of WDM rings (WDM = Wavelength Division Multiplex) according to a 1:N scheme or an M:N scheme. In this connection, the protection may take place at the level of an optical-multiplex section (= OMS) of such a ring, such as, e.g., disclosed in reference [2], or at the level of an optical channel (= OCH). A further object of the invention therefore is to also provide for an annular optical network whose capacity of signal transmission may be increased by applying low-priority traffic over protection connections present in such rings. An annular optical network according to the preamble of claim 13, known per se from reference [2], for this purpose is characterised, according to the invention, as in claim 13.

Other preferred embodiments of the invention have been summarised in further subclaims.

The invention makes possible a more effective use of the capacity of optical networks in general, and annular optical WDM networks in particular. By applying low-priority traffic over protection connections according to a 1:1 scheme during undisturbed operation, the capacity of the network may even be substantially doubled. The reaction time for having the low-priority traffic give way to the high-priority traffic is substantially restricted only by the switching time of optical switches which, for the current prior art, lies in the range of several microseconds to several milliseconds. The decision to switch over is taken locally in the optical domain, therefore requires no central control or any other signalling in the optical network, and may be carried out relatively fast. Nodes of an optical network may basically be arranged identically for adding or dropping low-priority traffic, not only for such traffic between adjacent nodes, but also for transit traffic.

C. REFERENCES

- [1] R. Ramswami & K.N. Sivarajan, "Optical Networks: A Practical Perspective", Morgan Kaufmann Publishers, Inc., San Francisco, California, 1998; more particularly Chapter

10 "Control and Management", Section 10.4.1 "Protection Concepts", pp. 430-434;

- [2] F. Arecco et al., "A transparent, all-optical, metropolitan network experiment in a field environment: The "PROMETEO" self-healing ring", J. Lightwave Technol., Vol. 15, No. 12, December 1997, pp. 2206-2213.

D. BRIEF DESCRIPTION OF THE DRAWING

The invention will be explained in greater detail by reference to a drawing comprising the following figures:

- FIG. 1 schematically shows a first exemplary embodiment of the invention;
- FIG. 2 shows a first variant for a component of the exemplary embodiment according to FIG. 1;
- FIG. 3 shows a second variant for an identical component as the one shown in FIG. 2;
- FIG. 4 shows a first variant for a component of the exemplary embodiment shown in FIG. 1 for application in a WDM connection;
- FIG. 5 shows a second variant for an identical component as the one shown in FIG. 4;
- FIG. 6 schematically shows an annular optical network to which the invention is applied;
- FIG. 7 schematically shows a node of the network according to FIG. 6;
- FIG. 8 shows a scheme for wavelength allocation for WDM channels for transmitting WDM signals over the network of FIG. 6;
- FIG. 9 schematically shows a component of the node shown in FIG. 7.

E. DESCRIPTION OF EXEMPLARY EMBODIMENTS

The exemplary embodiments described below are restricted, only for reasons of simplicity of description, to a protection configuration according to a 1:1 scheme. The principle of the invention, however, is also applicable to protection connections

in protection configurations according to the more general schemes 1:N and M:N.

FIG. 1 schematically shows a protection configuration according to a 1:1 scheme, to which the invention is applied. The configuration comprises a point-to-point connection between a (signal) source S and a (signal) destination D, which may be part of a more extensive optical network, the source and the destination being located in different nodes N_1 and N_2 of the network, as drawn, but which may also be separate. Between the source S in node N_1 and the destination D in node N_2 , two physically separated, optical signal connections are located, namely, an operational connection WF ("working fibre") and a protection connection PF ("protection fibre") which runs by way of, e.g., network nodes N_3 and N_4 . Said two connections are placed between a first protection switch PS_1 in node N_1 at the side of the source, and a second protection switch PS_2 in node N_2 at the side of the destination. In normal, i.e., undisturbed operation, the protection switches are in switch modes such that signal traffic between the source S and the destination D takes place by way of the operational connection WF. In the event of a disturbance of the operational connection WF, e.g., due to fibre rupture, in both protection switches switching over to the protection connection PF takes place. The control of the protection switches, which are not further denoted in the figure, takes place in the known way and is not per se part of the invention. In the protection connection PF, two optical switches S_1 and S_2 are included, which enclose a section PF_1 of the protection connection between network nodes N_3 and N_4 . The switches S_1 and S_2 may be switched between a first switch mode (parallel mode in the figure, having interrupted lines), in which first and second ports p_1 and p_2 are interconnected with third and fourth ports p_3 and p_4 , respectively, and a second switch mode (cross mode in the figure, having drawn lines), in which the first and second ports p_1 and p_2 are interconnected with the fourth and third ports p_4 and p_3 , respectively. The switches S_1 and S_2 are controlled by control signals given off by signal-detecting means M_1 and M_2 , respectively, which are coupled to the

optical signal-tapping means C_1 and C_2 , respectively, placed at the first port p_1 of the switches S_1 and S_2 . The signal-tapping means are measured and orientated in such a manner that they tap a fraction, e.g., 10%, of the power of an optical signal entering at the port p_1 of the switch in question, and conduct it to the detection means coupled to the tapping means.

The configuration operates as follows. A distinction is made between signal traffic having a high priority and signal traffic having a low priority. The signal traffic between the source S and the destination D is traffic having a high priority, denoted in the figure by tr_h , and hereinafter is also denoted by high-priority signal tr_h . In the event of undisturbed operation, the signal traffic having a high priority, tr_h , is conducted over the operational connection WF . Only in the event of disturbance on the operational connection, the protection switches PS_1 and PS_2 are switched over, and the traffic tr_h between the source S and the destination D is conducted by way of the protection connection PF . In order not to leave the protection connection unused in the event of undisturbed operation, in order to increase the signal-transport capacity in the network, signal traffic is conducted over at least a portion of the protection connection PF , in this case section PF_1 . Said traffic, which is referred to as signal traffic having a low priority or low-priority signal, denoted by tr_l , must disappear from the protection connection, however, as soon as use is to be made of the protection connection by the signal traffic having a high priority. In the undisturbed situation, the switches S_1 and S_2 both are in the cross mode indicated above. Now, there are two options for conducting the signal traffic having a low priority tr_l over the section PF_1 of the priority connection PF in question. According to the first option, referred to as the co-directional variant, the signal traffic tr_l (continuous arrow) is added, via the second port p_2 of the switch S_1 , to the connection section PF_1 , and is dropped therefrom at the fourth port p_4 of the second switch S_2 . According to the second option, referred to as the counter-directional variant, said signal traffic is added to

the connection section PF_1 in the opposite direction (interrupted arrow) by way of the fourth port p_4 of the switch S_2 , and dropped from it at the second port p_2 of the first switch S_1 . Due to the cross mode of the switches, section PF_1 is disconnected, as it were, from the total protection connection for the benefit of use for signal traffic having a low priority. As soon as the high-priority signal tr_n is conducted over the protection connection PF by switching over the protection switch PS_1 , however, the protection connection must be restored as soon as possible. For this purpose, as soon as the arrival of the high-priority signal at the port p_1 of the switch S_1 in node N_1 is detected by the detecting means M_1 , the switch S_1 is set to the parallel mode. The high-priority signal tr_n propagates over the section PF_1 , further in the direction of the second switch S_2 in node N_4 . There, the arrival of said signal at the port p_1 of the second switch S_2 is detected by the detection means M_2 , and the switch S_2 is set to the parallel mode. After switching over the switches S_1 and S_2 to the parallel mode, the protection connection PF is restored, and the low-priority signal tr_L , in the co-directional variant at switch S_1 in node N_1 , and in the counter-directional variant at switch S_2 in the node N_4 is no longer added to the section PF_1 , and the high-priority signal tr_n is conducted to the destination D . The counter-directional variant has the advantage that the detection means M_1 and M_2 , due to a direction-selective arrangement of the signal-tapping means C_1 and C_2 , do not require any further measures to be capable of detecting the arrival of the high-priority signal tr_n . The counter-directional variant, however, is less simple to combine with optical amplifiers. In the co-directional variant, it is a requirement that, at any rate in the node N_4 , with the detection means M_2 together with the tapping means C_2 , a selective differentiation is possible between states in which, at the port p_1 , the high-priority signal tr_n is, and is not, present. This may be achieved, e.g., by having the high-priority and low-priority signal traffic take place at various wavelengths, more generally at various wavelength spectra, and, e.g., render the tapping means C_2 or the detection means M_2 wavelength-selective for the wavelength, or

(part of) the wavelength spectrum in which the wavelength spectrum of the high-priority signal differs from that of the low-priority spectrum, as the case may be. In order to keep the configuration unequivocal, the tapping means C_1 or the detection means M_1 preferably have one and the same wavelength selectivity. A detection mechanism which is based on wavelength selectivity is very efficient in the event that the high-priority and/or low-priority signals are WDM signals (see below).

In either variant - the co-directional and the counter-directional - instead of wavelength or directional selectivity, use may be made of detection means which are selective for a signal which is typical for the high-priority signal, and which is not present in the low-priority signal, such as a pilot signal having a specific modulation which may be recognised by the detection means.

The protection connection PF may be broken down into several sections, similar to the section PF_1 , for the benefit of still more low-priority traffic, e.g., in the event that the protection connection runs by way of still other network nodes. In this case, the priority connection PF includes three or more switches, similar to the switches S_1 and S_2 , having associated detection means. In this connection, transit traffic is also possible by setting interim switches in the parallel mode, as required. Upon arrival of the high-priority signal, these need no longer be switched over.

The application of tapping means at the first port p_1 of the switches S_1 and S_2 , for the benefit of the detection of the high-priority signal, has the drawback that, in the event of use of the protection connection PF, the signal is weakened too much when passing a number of switches. This may be prevented by placing the tapping means at the fourth port p_4 of each switch. This is shown in FIG. 2 for a switch S_1 and tapping means C_1 .

If for a switch the port p_4 is not in use for adding or dropping the low-priority signal, in the counter-directional and the co-directional variant, respectively, the detection means may also be connected directly to the port p_4 . This is shown in FIG. 3 for a switch S_1 and detection means M_1 .

In the exemplary embodiments described so far, both the high-priority and the low-priority signal may be an optical WDM signal, which signals are completely switched by the various switches. If, however, the high-priority signal is a WDM signal comprising a number of n WDM channels, each WDM channel corresponding to a separate wavelength λ_i ($i=1, \dots, n$) in the WDM signal, basically any WDM channel may also be utilised separately over one or more sections of the protection connection, for signal transmission having a low priority. For this purpose, an Optical Add/Drop Multiplexer is added, hereinafter to be referred to as OADM, at the beginning and at the end of each section, instead of a singular switch with associated detection means, such as the switches S_1 and S_2 in FIG. 1. The individual WDM channels are further denoted by their wavelength λ_i ($i=1, \dots, n$). FIG. 4 shows a first variant thereof in a counter-directional embodiment, an OADM 40 being included in a protection connection. The OADM comprises a bidirectional (de)multiplexer 42 having an I/O port 44 and a bidirectional (de)multiplexer 46 having an I/O port 48, for splitting off and rejoining a number of n WDM channels $\lambda_1, \dots, \lambda_n$ in either signal-transmission direction. In the WDM channels $\lambda_1, \dots, \lambda_n$, optical 2×2 switches SP_1, \dots, SP_n are included, provided with detection means MM_1, \dots, MM_n , all this for each WDM channel in a similar way as the switch S_1 or S_2 with associated detection means in FIG. 1. For adding or dropping signals having a low priority \hat{u} at the fourth and the second port of the switches, respectively, in the event of undisturbed operation the switches SP_1, \dots, SP_n are in the cross mode. As soon as the high-priority tr_1 enters the I/O port 44 of the (de)multiplexer 42 as a WDM signal, said signal is split up into signal components in the various WDM channels $\lambda_1, \dots, \lambda_n$. Subsequently, in each channel the possibly present signal component of the high-priority signal is detected separately and, after switching over the switch associated with the channel, passed on to the (de)multiplexer 46, and finally rejoined, together with signal components of the high-priority signal passed on in other channels, to form a WDM signal of the high-

priority signal tr_n which propagates itself further over the protection connection by way of I/O port 48.

In a similar way as in FIG. 4, FIG. 5 shows a second variant for a WDM application, this time in a co-directional embodiment. In said variant, the high-priority signal tr_n is a WDM signal which, apart from the number of n WDM channels still comprises an additional WDM channel having a specific wavelength λ_s , which has a recognition function for the high-priority signal on the protection connection, and whose presence of the high-priority signal on the protection connection is therefore unequivocally capable of being detected. This additional WDM channel, which hereinafter will also be referred to as signature channel λ_s , may already be associated with the high-priority signal over the operational connection, but may also be added to the signal only upon transition to the protection connection. The high-priority signal including the signature channel is denoted by $tr_n(\lambda_s)$. FIG. 5 shows an OADM 50 included in a protection connection at the beginning or the end of each section of said connection which is used for low-priority traffic. The OADM 50 comprises a demultiplexer 52 having an input port 54 and a multiplexer 56 having an output port 58, respectively, for splitting off and rejoining a number of n WDM channels $\lambda_1, -, \lambda_n$ and the additional WDM channel λ_s . In the WDM channels $\lambda_1, -, \lambda_n$, optical 2×2 switches $SQ_1, -, SQ_n$ are included, all this for each WDM channel in a similar way as the switches S_1 or S_2 in FIG. 1, this time without the associated detection means. Detection means MM are coupled to the additional WDM channel λ_s , for simultaneously driving the switches $SQ_1, -, SQ_n$ in the WDM channels $\lambda_1, -, \lambda_n$. For adding or dropping signals having a low priority tr_l , at the second and the fourth port of the switches, respectively, the switches $SQ_1, -, SQ_n$ in the event of undisturbed operation are in the cross mode. The recognition channel λ_s in this connection is not used for low-priority traffic. As soon as the WDM signal of the high-priority signal $tr_n(\lambda_s)$ enters the input port 54 of the demultiplexer 52, it is split up into signal components in the various WDM channels $\lambda_1, -, \lambda_n$ and λ_s . Subsequently, the presence

of the high-priority signal is detected with the detection of the signal component in the recognition channel λ_n and the switches SQ_1, \dots, SQ_n in the WDM channels $\lambda_1, \dots, \lambda_n$ are switched over, as a result of which the signal components are passed on to multiplexer 56. There, the signal components in the various WDM channels are rejoined to form a WDM signal of high priority $tr_n(\lambda_n)$, which may propagate via the output port 58 over a protection connection coupled thereto.

Both the OADM 40 in FIG. 4 and the OADM 50 in FIG. 5 may be arranged to still process signals in other WDM channels, denoted in the figures by $\{\lambda_v\}$, which relate to operational signal traffic having a protection path by way of another part of the network (not shown). For this purpose, there may also be utilized the operational connection WF of FIG. 1 itself, provided the nodes N_1 and N_2 are equipped with fitting OADMs for that purpose. Such a protection principle is applied, inter alia, in annular optical transmission networks having a protection configuration for the transmission of WDM signals. In such networks, hereinafter to be denoted, for briefness' sake, by WDM rings, three or more nodes are included in, and mutually connected by, (at least) two optical connections forming two rings, hereinafter to be referred to as a double ring, for the transmission of WDM signals between the nodes in two transmission directions opposite to one another. In this connection, each node is provided with protection-switching means for switching over from signal transmission over an operational connection in a first or in a second transmission direction to signal transmission over a protection connection by way of the double ring in the second or in the first transmission direction, respectively. In this connection, an operational connection by way of a section of the double ring between each pair of adjacent nodes in the double ring always has a protection connection by way of a portion of the double ring which is complementary to said section, in the event that the operational connection over said section of the double ring ends up in an error condition. In WDM rings having so-called optical multiplex section protection (= OMS protection), the entire complementary portion

belongs to the protection connection. In WDM rings having optical channel protection (= OCH protection) the complementary part is not necessarily part, as a whole, of the protection connection, all of this depending on which nodes of the double ring have the high-priority traffic over the operational connection as its source and its destination. In either type of WDM ring, it is basically possible to conduct low-priority traffic over the protection connections present in the rings, both in the co-directional and in the counter-directional embodiment, in a way as described above.

Below, on the basis of the figures FIG. 6 to 9 inclusive, a specific form of WDM ring is described having OMS protection, to which the invention is applied. FIG. 6 shows such a network RN having four nodes RN1, RN2, RN3 and RN4, which are included in a double ring DR, comprising an outer ring R1 and an inner ring R2, respectively, having signal traffic between the nodes in a first transmission direction (clockwise in the figure), and having signal traffic in a second transmission direction (anticlockwise). As schematically shown in FIG. 7, a node 70, such as a node RN_i (with $i=1, \dots, 4$) of the double ring DR, comprises a first OADM 71 and a second OADM 72, included in the outer ring R1 and in the inner ring R2, respectively, for adding and dropping (arrows A/D) of WDM channels on the double ring DR in either transmission direction. Furthermore, the node 70 comprises protection switches 73 and 74, included on either side of the OADMs in the double ring DR. The protection is such that, in the event of normal operation, the rings R1 and R2 are intact. However, in the event of an error condition, in an operational connection over a section between two adjacent nodes or in a node itself, the protection switches, e.g., under the control of a central operating system, or also with the help of detection means in the optical domain, on either side of the section in question of the double ring, or on either side of the node in question, are switched in such a manner that the section, or the node having the error condition, is disconnected from the double ring. In this connection, the operational signal traffic in question over the double ring in the one transmission direction

in the protection switch is reversed in direction for the disconnected part of the double ring, and conducted over the double ring in the other transmission direction as protection signal traffic.

Over both the inner ring and the outer ring, signal traffic is possible of WDM signals comprising $2n+2$ different WDM channels. FIG. 8 shows a diagram of the wavelength allocation of the various WDM channels. To the outer ring R1, belongs a first set $\{W1\}$ of $n+1$ WDM channels, i.e., n channels $\lambda_1, \dots, \lambda_n$ and a recognition channel λ_{n+1} , which form operational channels for operational signal connections by way of the outer ring. To the inner ring R2, belongs, similarly, a first set $\{W2\}$ of $n+1$ WDM channels, i.e., $\lambda_{n+1}, \dots, \lambda_{2n}$, and a recognition channel λ_{n+2} , which form operational channels for operational signal connections by way of the inner ring. Furthermore, both the outer ring R1 and the inner ring R2 are associated with a second set, or the set $\{P2\}$ of the WDM channels $\lambda_{n+1}, \dots, \lambda_{2n}$, as the case may be, and the recognition channel λ_{n+1} and the set $\{P1\}$ of the WDM channels $\lambda_1, \dots, \lambda_n$ and the recognition channel λ_{n+1} , which form protection channels for protection traffic, on the outer ring R1 in the event of an error condition of an operational connection on the inner ring R2, and on the inner ring R2 in the event of an error condition of an operational connection on the outer ring R1, respectively. Over the sections of both the outer ring R1 and the inner ring R2 between each pair of adjacent nodes, such as, e.g., the pair RN2 and RN3, or the pair RN4 and RN1, over the recognition channels λ_{n+1} and λ_{n+2} from the first sets $\{W1\}$ and $\{W2\}$, respectively, of operational channels, permanent, so-called next-door-neighbour connections nb are maintained, such as, e.g., the next-door-neighbour connections nb over the section of the outer ring R1 between the nodes RN1 and RN2, and over the section of the inner ring R2 between the nodes RN1 and RN4. In the event of an undisturbed operation, the protection channels of the second sets $\{P1\}$ and $\{P2\}$, with the exception of the recognition channels λ_{n+1} and λ_{n+2} on the outer and inner rings, may be reused for signal traffic having a low priority, which must make way

upon the appearance of signal traffic having a high priority, i.e., protection traffic originating from operational channels corresponding to the protection channels in question of the first sets $\{W1\}$ and $\{W2\}$. For this purpose, in each OADM of each node, the protection channels are provided with switching means and with detection means for controlling the switching means, all of this in a similar manner as in the OADM 50 (see FIG. 5). FIG. 9 schematically shows an OADM 90, included in the outer ring R1. The OADM 90 includes a demultiplexer 92 having an input port 93 and a multiplexer 94 having an output port 95, between which the channels of the first set $\{W1\}$ of operational channels and of the second set $\{P2\}$ of protection channels are split up. In the operational channels, A/D switching means are included 96 for adding/dropping or switching through signals in each channel separately. In the recognition channel λ_{e1} of the set $\{W1\}$ of operational channels, an A/D switch 98 is included, which in the figure is shown separately to indicate that it is permanently in the cross mode for the benefit of the next-door-neighbour connections nb in the incoming and outgoing directions. In the protection channels, with the exception of the recognition channel λ_{e2} , switching means SQ are included for adding/dropping or switching through signals having a low priority $tr_L(1)$ in each protection channel separately over the outer ring R1. To the recognition channel λ_{e2} of the set $\{P2\}$ of protection channels, detection means MM are coupled for collectively controlling the switching means SQ. When the presence of a high-priority signal $tr_H(\lambda_{e2})$ is detected on the input port 93 of the demultiplexer 92 in the recognition channel λ_{e2} , all protection channels are switched through by the switching means SQ, in such a manner that no low-priority signals $tr_L(1)$ can be added or dropped any longer.

Such a WDM ring has the great advantage that, as a result of the permanent presence of a next-door-neighbour connection between each pair of adjacent nodes over a WDM channel having the same wavelength, i.e., the recognition channels λ_{e1} and λ_{e2} on the outer ring and the inner ring, respectively, in the event of an

error condition on a signal connection over any operational channel whatsoever, the protection signal, anywhere on a protection connection over the double ring, always comprises the recognition channel in question and is capable of being detected thereon in the optical area.

In the event of the exemplary embodiments described, the cooperation of the detection means and the switching means preferably is such that, if the high-priority signal is no longer detected on the protection connection, the switching means are switched back to switch modes in which low-priority traffic is once again possible.

Set of Amended CLAIMS

1. Method for transmitting optical signals having several priorities via a transmission network with protection,

5 comprising steps of:

- transmitting an optical signal carrying traffic with a high priority, hereinafter called high priority signal (tr_H), via an operational connection (WF; R1, R2) through the network,

10 - transmitting an optical signal carrying traffic with a low priority, hereinafter called low priority signal (tr_L), via at least a part (PF1) of a protection connection (PF; R2, R1),

15 - protection switching for switching the traffic with high priority from being carried by an optical signal transmitted via the operational connection to being carried by an optical signal transmitted via the protection connection in the event of an error condition, and

20 - giving way the transmission of the low priority signal via at least said part of the protection connection in the event of said error condition under control of a detection of an optical signal

signalling that a protection switching has occurred,

25 characterised in that

the transmission network is an optical network, in which the step of protection switching is carried out in such a way that the high priority signal (tr_H) is switched by optical switching means (PS1; 73, 74) from the operational connection (WF; R1, R2) to the protection connection (PF; R2, R1), and

30 the step of giving way is carried out upon detection of a signal characteristic of the high priority signal (tr_H) on the protection connection (PF; R2, R1).

2. Transmission method according to claim 1, characterised in that the transmission of the low priority signal is carried out at a first wavelength spectrum (λ_1 , - λ_n), the transmission of the high priority optical signals is carried out at a second wavelength spectrum (λ_1 , - λ_n , λ_s), which differs from the first wavelength spectrum, and the optical detection is carried out on the optical characteristic which corresponds to a difference spectrum (λ_s), in which the second wavelength spectrum differs from the first one.

3. Transmission method according to claim 1, characterised in that the transmission of the low priority signal being carried out in a direction opposite to the one of the transmission of the high priority signal in the event of an error condition of the operational connection, and the optical detection is carried out in a direction-selective manner.

4. Transmission method according to claim 1, characterised in that the high priority signal includes a signal which is specific for the high priority signal, and the optical detection is carried out in a manner selective for said specific signal.

5. Transmission method according to claim 2, 3 or 4, characterised in that the switching is carried out by switching means (S1; S2; S3; S4) between a first switching mode, in which the low-priority signal is added or dropped, respectively to and from the protection connection, and a second switching mode, in which the high-priority signal passes on over the protection connection.

6. Transmission method according to claim 5,
characterised in that the optical detection includes
optical-power splitting by optical-power splitting means
(C1) for tapping a part of the optical power present on a
port (p1) of the switching means (S1) to which an incoming
end of the protection connection (PF) is coupled.

7. Transmission method according to claim 5,
characterised in that the optical detection includes
optical-power splitting by optical-power splitting means
(C3) for tapping a portion of the optical power present on
a port (p4) of the switching means (S3) which, in the
first switching mode, are connected through to a further
port (p1) of the switching means to which an incoming end
of the protection connection (PF) is coupled.

8. Transmission method according to claim 5,
characterised in that the optical detection is carried out
directly on a port (p4) of the switching means (S4),
which, in the first switching mode, is connected through
to a further port (p1) of the switching means to which an
incoming end of the protection connection (PF) is coupled.

9. Transmission method according to any of the
claims 1,-,8, characterised in that:
the high- and/or low-priority signals are optical WDM
signals (λ_1 , -, λ_n , λ_s ; {W1}, {W2}, {P1}, {P2}).

10. Transmission method according to claim 1, 2 or 3,
characterised in that:
the high- and low-priority signals are WDM signals, with
the WDM signal of the low-priority signal comprising a
number of WDM channels (λ_1 , -, λ_n) which is at least a subset

of the number of WDM channels ($\lambda_1, \dots, \lambda_n$; $\lambda_1, \dots, \lambda_n, \lambda_s$) in the WDM signal of the high-priority signal, on either side of said part (PF1) of the protection connection, an OADM (40; 50) is included of which the switching means (SP_1, \dots, SP_n ; SQ_1, \dots, SQ_n) and detection means (MM_1, \dots, MM_n ; MM) are part, and in that, per OADM, the optical detection is carried out on at least one ($\lambda_1, \dots, \lambda_n$; λ_s) of the WDM channels of the high-priority signal, and the switching is carried out per WDM channel of the low-priority signal through switching means (SP_1, \dots, SP_n ; SQ_1, \dots, SQ_n) under control of the optical detection (MM_1, \dots, MM_n ; MM), the switching means having a first switching mode for adding and dropping a low priority signal and a second switching mode for passing on a high priority signal.

11. Transmission method according to claim 10, characterised in that the high-priority signal includes a WDM channel having a wavelength (λ_s) which is specific to the high-priority signal, and that the optical detection is carried out by detection means (MM) coupled to the WDM channel having said specific wavelength.

12. Transmission method according to claim 10, characterised in that the optical detection is carried out per WDM channel ($\lambda_1, \dots, \lambda_n$) by means of an optical signal detector (MM_1, \dots, MM_n) for controlling the switching means (SP_1, \dots, SP_n) associated with the WDM channel in question.

13. Annular optical transmission network with protection, for the transmission of optical WDM signals, comprising: a number of nodes (RN_1, \dots, RN_4) included in, and mutually connected by, two optical connections forming two optical rings, hereinafter separately also referred to as first

ring (R1) and second ring (R2), for optical signal transmission of WDM signals in two mutually opposite transmission directions between the nodes,

each node (70) comprising a first OADM (71) included in the first ring (R1) and a second OADM (72) included in the second ring (R2), and optical protection-switching means (73, 74) included between the two rings on either side of the first and second OADM's for optical protection-switching of WDM-signals between the two optical rings,

characterised in that

- each (R1;R2) of the two rings includes:

+ a first set of WDM channels ($\{\lambda_w\}; \{W1\}; \{W2\}$), called operational channels, for forming operational connections over a concerned one (R1; R2) of the two rings for the transmission of optical signals of high priority, and

+ a second set of WDM channels ($(\lambda_1, -, \lambda_n); (\lambda_1, -, \lambda_n, \lambda_s); \{P2\}; \{P1\}$), called protection channels, for the transmission of optical signals of low priority ($tr_L; tr_L(1)$) in normal operation, and for forming protection connections over said concerned one (R1; R2) of the two rings for high priority signals ($tr_H; tr_H(\lambda_s2)$) upon occurrence of protection-switching in the event of an error condition of an operational connection over the other one (R2; R1) of the two rings, and

- each OADM (40; 50; 90) includes:

+ optical switching means ($\{SP1, -, SPn\}; \{SQ1, -, SQn\}; SQ$) for switching on and off low priority signals ($tr_L; tr_L(1)$) over any of the protection channels of a ring concerned (R1;R2), and

+ optical detection means ($\{MM1, -, MMn\}; MM$) for detecting a high priority signal on at least one

protection channel $(\lambda_1, -, \lambda_n; \lambda_s; \lambda_{s2})$ of the set of protection channels.

14. Annular optical transmission network according to claim 13, characterised in that the first set $(\{W1\}; \{W2\})$ of WDM channels of each $(R1; R2)$ of the two rings includes a recognition channel $(\lambda_s; \lambda_{s1}, \lambda_{s2})$, which corresponds to a recognition channel having the same specific wavelength $(\lambda_s; \lambda_{s1}, \lambda_{s2})$ included in the second set $(\{P1\}; \{P2\})$ of WDM channels of the other one $(R2; R1)$ of the two rings, the and the optical detection means (MM) of each OADM have been coupled to the recognition channel $(\lambda_s; \lambda_{s1}, \lambda_{s2})$ of the second set of WDM channels for driving the switching means $(SQ1, -, SQn; SQ)$ of the WDM channels of the second set, the recognition channel of the first set of operations channels of one $(R1; R2)$ of the two rings having a specific wavelength $(\lambda_s; \lambda_{s1}, \lambda_{s2})$ for recognising the high priority signal on the corresponding recognition channel of the second set of WDM channels of the other one $(R2; R1)$ of the two rings.

15. Annular optical transmission network according to claim 14, characterised in that each OADM includes an add/drop means (98) for adding and dropping the recognition channel (λ_{s1}) of the first set $(\{W1\})$ of WDM channels.

16. Annular optical transmission network according to claim 15, characterised in that the detection means include an optical-signal detector $(MM1, -, MMn)$ per WDM channel $(\lambda_1, -, \lambda_n)$ for controlling the switch $(SP1, -, SPn)$ associated with the WDM channel in question.

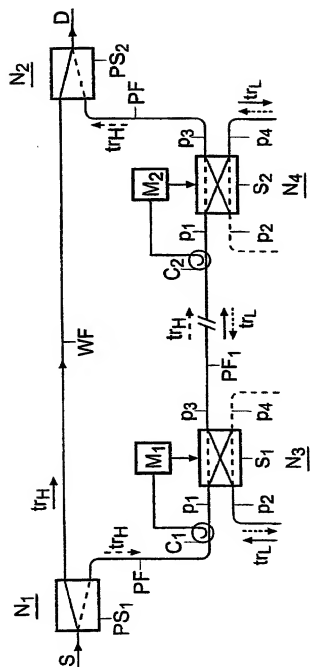


FIG. 1

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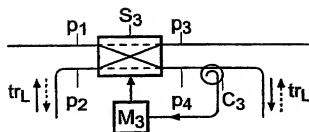


FIG. 2

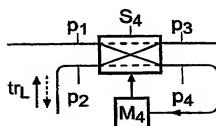


FIG. 3

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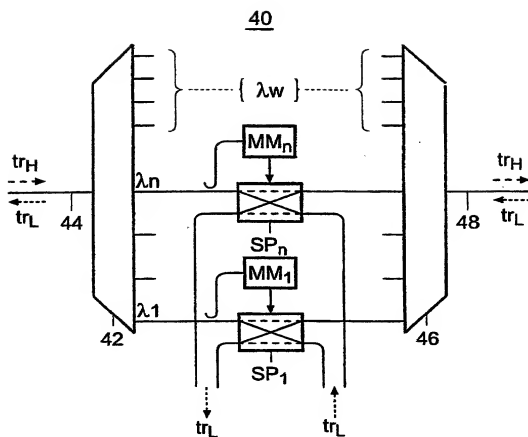


FIG. 4

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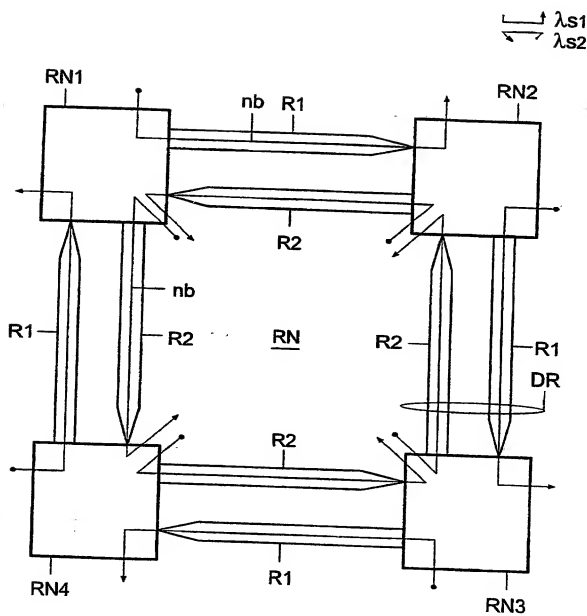


FIG. 6

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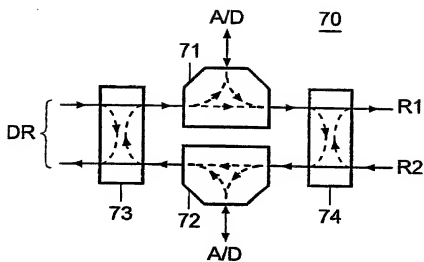


FIG. 7

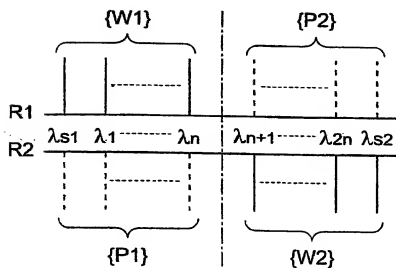


FIG. 8

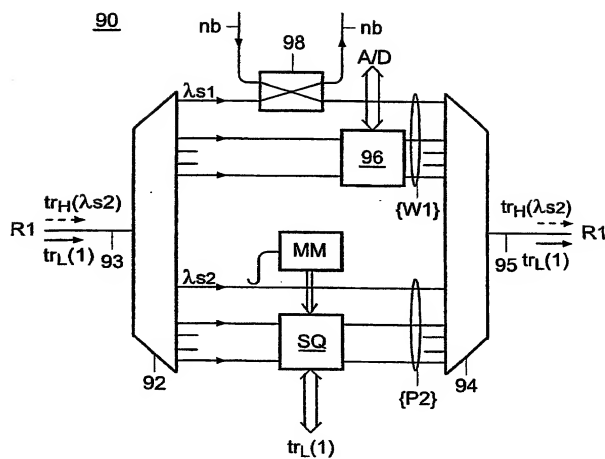


FIG. 9

**DECLARATION AND
POWER OF ATTORNEY**
(Utility Patent Application)

As a below named inventor, I hereby declare:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below), of the subject matter which is claimed and for which a patent is sought on the invention entitled:

"Optical transmission network having a protection configuration."

the specification of which:

— is attached hereto
— was filed on _____ as Application Serial No. _____
— with amendment(s) filed _____
X was filed as PCT international application: PCT/EP00/06403
and was amended under PCT Article 19 on 8 October 2001

hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the patentability of this application in accordance with Title 37, Code of Federal Regulations section 1.56.

I hereby claim foreign priority benefits under Section 119 of Title 35, United States Code for the above-identified US patent application based on the patent or inventor's certificate identified below and having a filing date before that of the US patent application for which priority is claimed:

Priority Claimed

| <u>Application No</u> | <u>Country</u> | <u>Filing Date</u> | <u>under 35 USC 119</u> |
|-----------------------|----------------|--------------------|-------------------------|
|-----------------------|----------------|--------------------|-------------------------|

1012568

NL

July 12, 1999

YES

I hereby claim the benefit under Section 120 and/or Section 119(e) of Title 35 of the United States Code of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by Section 112 of Title 35 of the United States Code, I acknowledge the duty to disclose material information, as defined in Section 1.56 of Title 37 of the Code of Federal Regulations, which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

| <u>Application Serial No.</u> | <u>Filing Date</u> | <u>Patented</u> | <u>Pending</u> | <u>Abandoned</u> |
|-------------------------------|--------------------|-----------------|----------------|------------------|
|-------------------------------|--------------------|-----------------|----------------|------------------|

Status

Power of attorney:

As a named inventor, I hereby appoint:

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as my attorneys to prosecute this application and to transact all business in the United States Patent and Trademark Office in connection therewith.

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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Date: January 16, 2002